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ABSTRACT

This study compares an instructor-managed (IMI) and a computer-managed (CMI) version of a modularized, individualized Navy Training course; the main difference between groups was in testing and remediation. Subjects were 240 students enrolled in the Propulsion Engineering School at Great Lakes, Illinois, who were divided into three groups: CMI group, IMI-conventional (students followed normal school procedures and scored their own lesson tests), and IMI-control (instructors scored and remediated lesson tests). Dependent measures included: (1) module test scores for all three conditions, (2) lesson test scores for the IMI-control and CMI conditions, (3) comprehensive test scores for all three conditions, (4) time to complete the course for all three test conditions, and (5) time instructors spent on various activities. A 3 (groups) by 13 (modules) analysis of variance was performed on module test scores. There do not appear to be any major performance differences between the CMI group and the IMI groups. The course completior time data indicate that CMI does result in time savings; CMI also resulted in more free time and less test scoring for instructors. (VT)

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A COMPARATIVE EVALUATION OF COMPUTER-MANAGED AND INSTRUCTOR-MANAGED INSTRUCTION

by

John A. Ellis

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A Comparative Evaluation of Computer-Managed and Instructor-Managed Instruction

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The U. S. Navy is currently operating the largest computer managed instructional (CMI) system in the world. Approximately 5,500 students located in eight different schools in four separate locations are managed by the system each day. The management functions performed include; test grading, extensive record keeping, remediation, prescription of study assignments, and monitoring of student progress. The system is projected to expand considerably in the next five to ten years, therefore, Navy training managers are continually interested in obtaining reliable information concerning its benefits and effectiveness.

To date only one experimental study of the Navy system has been accomplished. Carson, Graham, Harding, Johnson, Mayo, and Salop (1975) did an initial evaluation in two short courses taught at the Naval Air Technical Training Center in Memphis, Tenn. CMI was compared to (a) conventional classroom instruction and (b) a student-paced system based on the instructional and test materials developed for CMI, but which substituted instructor performed operations for some of the computer provided operations. The latter procedure was designated instructor-managed instruction (IMI). Carson, et. al. (1975) found that both CMI and IMI reduced training time by 50 percent, and slightly improved scores on criterion referenced knowledge tests, relative to classroom instruction. There were no differences between the CMI and IMI conditions on either of these measures. This may have been due to uncontrolled variables that minimized differences between the groups. In addition, the experimental design and preconditions precluded a precise comparison between CMI and IMI in terms of instructor duties and activities (e.g. time spent grading tests, time spent counseling, free time, record keeping, etc.).

The present study also compares an instructor managed and a computer managed version of a Navy Technical course. However, unlike the Carson, et. al. (1975) study, conditions permitted tighter experimental control and an analysis of instructor activities.

Background. The study was conducted at the Propulsion Engineering School at Great Lakes, Illinois. The Propulsion Engineering School is the "A" school for three engineering ratings: Machinist's Mate, Boiler Technician, and Engineman. The curriculum for all ratings is completely individualized. All testing is criterion referenced, and hands on training occupies 30 percent of each student's instructional time. The curriculum is divided into modules. The first 13 form a common core of basic knowledge and skill units which students in all three ratings take. The opportunity for the present study arose when the first 13 modules were scheduled to be placed on the CMI system. The plan for CMI implementation did not involve any changes in the existing instructional or test materials, therefore, a relatively well controlled comparison of the old instructor-managed course (IMI) and the CMI system could be made.

The main difference between the IMI and CMI versions of the first 13 modules was in testing and remediation procedures. Three types of tests are given in the course: (a) lesson tests are given at the end of lesson within a module, (b) module tests are given at the end of each module, and (c) a comprehensive test is given at the end of the first 13 modules. Under CMI, all tests are computer scored and remediation statements are printed out for missed questions. Under IMI the comprehensive and module tests were instructor scored and remediated. Lesson tests were scored by the students; the answers were provided in the test booklet. Thus, IMI students could elect not to take the lesson tests or could just look up the answers in the test booklet.

The present study controls for this discrepancy between IMI and CMI procedures by including an IMI group (IMI-control) in which instructors scored and remediated lesson tests. Two additional groups were run: (a) the CMI group and (b) an IMI group (IMI-conventional) in which students followed normal school procedures and scored their own lesson tests.

Method

Subjects. Subjects were 300 students enrolled in the Propulsion Engineering school at Great Lakes, Illinois. Sixty subjects were eliminated due to incomplete data and random elimination to equate the number of subjects per group. The remaining 240 subjects were divided into 3 groups of 80. Subject assignment to groups was not entirely random. Because IMI and CMI were never run simultaneously (IMI was phased out before CMI was implemented) subject assignment was confounded with time of year. However, the two IMI conditions were run together and subject selection for these conditions was random.

Procedure. The experimental manipulations for the CMI and IMI-conventional groups required no change from the normal school procedures already described. For the IMI-control condition lesson tests were instructor scored and remediated, students were required to use the op-scan answer sheets used in CMI, and instructors were provided with a listing of the remedial statements given by the computer under CMI. In all conditions instructors were asked to record the amount of time spent in various activities each day.

Dependent measures included (a) module test scores for all three conditions (b) lesson test scores for the IMI-control and CMI conditions (c) comprehensive test scores for all three conditions (d) time to complete the course for all three conditions and (e) time instructors spent on various activities.

Results

Module Test Scores. A 3(groups) by 13(modules) analysis of variance was performed on module test scores. The only meaningfully significant difference was for modules, $F(12,2772) = 66.76$, $p<.001$. This finding indicates that some modules are more difficult than others.

Table 1

Percentage of time spent by instructors in each group in instructional and management activities

	EXPERIMENTAL CONDITION		
INSTRUCTOR DUTIES	IMI-control	IMI-conventional	CMI
Correcting Tests	50	25	11
Remediation	11	28	15
Counseling	9	6	23
Reviewing Records	9	13	6
Instruction	10	10	20
Orientation	8	6	6
Free Time	2	12	19

Lesson Test Scores. A 2(groups) by 30(lesson tests) analysis of variance compared lesson test scores for the IMI-control and CMI conditions. There were no significant differences.

Comprehensive Test Scores. A one-way analysis of variance done on comprehensive test scores for the three groups was significant $F(2, 264) = 6.54$, $p<.005$. Means for the groups were; CMI = 87.95, IMI-control = 90.75, IMI-conventional = 90.59. A post hoc Tukey (b) analysis revealed that the CMI group scored significantly lower than the two IMI groups, which did not differ.

Course Completion Time. A one-way analysis of variance was performed on number of class days to complete the first 13 modules for the three groups (weekends and holidays were excluded). There were no significant differences, however, CMI students averaged approximately one day less than IMI students. Means for the groups are: CMI = 13.57, IMI-control = 14.49, IMI-conventional = 14.64.

Instructor Activities. Table 1 presents the percentage of time spent by the instructors in each group in various instructor activities. It is clear that CMI increases free time and decreases test correcting relative to IMI. It should also be noted that free time was almost eliminated in the IMI-control condition while test correcting increased 25 percent relative to the IMI-conventional group.

Discussion

In general the results agree with the findings of Carson, et. al. (1975). There does not appear to be any major performance differences between the CMI group and the IMI groups. However, the small (three percent) but significant difference in comprehensive test scores in favor of the IMI groups was unexpected. One possible explanation for this result is the Armed Services Vocational Aptitude Battery (ASVAB) scores for the CMI group may have been significantly lower than scores for the IMI groups. This condition is attributable to the fact that the student population of the school differs as a function of time of year. Students attending in the fall and winter months tend to have higher ASVAB scores than students attending in the spring and summer months. The IMI data was collected in the late fall while the CMI data was collected in the early summer. Unfortunately, ASVAB scores for the CMI students used in this study were unobtainable because of privacy act restrictions, however, data obtained from a similar group of CMI students shows that their ASVAB scores are significantly lower than scores for the IMI-control and conventional students $t = 2.49$, $p<.05$. Mean scores are: CMI (summer) = 491, IMI-control and conventional (winter) = 503. Thus, the difference in comprehensive test scores could reflect ability differences among the groups.

The course completion time data indicates that CMI does result in time savings. Although there were no significant differences for course completion time CMI subjects completed the course one day faster than IMI subjects, on the average.

CMI also resulted in more free time and less test scoring for instructors. This result has important implications for instructor training and the instructor's role in an individualized CMI environment. If the time saving advantages of CMI are to be realized the role of the instructor must be examined in depth and changes in instructor scheduling and training must be made. For example, the instructor could be trained in academic counseling of slow learners or in techniques for motivating students in the impersonal individualized CMI situation. Requiring instructors to obtain and use skills such as these would make productive use of time saved by CMI.

References

Carson, S. B., Graham, L. L., Harding, L. G., Johnson, K. A., Mayo, G. D., & Salop, P. A. An evaluation of computer managed instruction in Navy technical training. San Diego: Navy Personnel Research and Development Center, June 1975. (Technical Report TR 75-38)